RECONSTRUCTING THE DEVILS CASTLE ROCK AVALANCHE, ALBION BASIN, UTAH

Patricia Pedersen (Jeffrey Moore)
Department of Geology and Geophysics

The Devils Castle rock avalanche is a bouldery, tonged-shaped, ~7m thick deposit found in the Albion Basin near Alta, Utah. The site (Figure 1) was subject to numerous glaciations during the Late Pleistocene, which undercut the cirque headwall, conditioning the slope for failure. Through carbon-14 dating, the landslide is estimated to have occurred >~9,000 years ago (Madsen & Currey, 1979). Site reconnaissance shows a minor glacial advance following the slide, which would put a likely estimate of occurrence during the Younger Dryas. This date will be further refined through cosmogenic surface exposure dating of the deposit (Laabs, et al., 2011).

Figure 1: Devils Castle

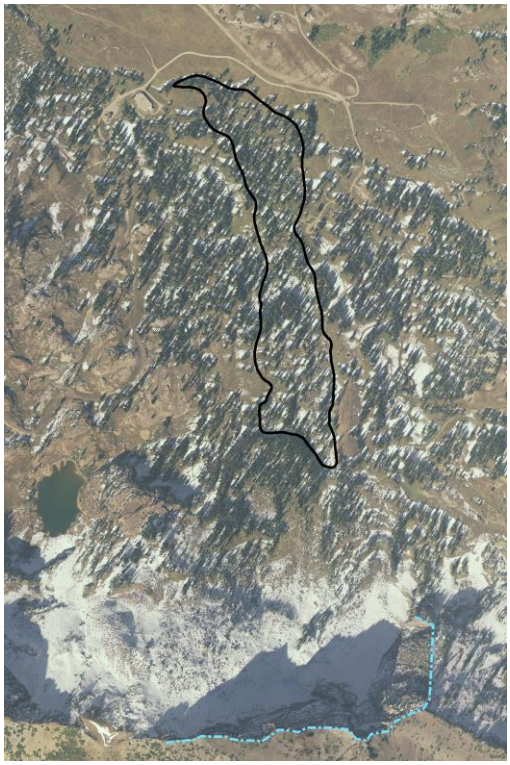

Figure 2: Boundary of slide with headwall marked.

Rock avalanches are low-frequency, high-magnitude slope failures characterized by high mobility and fluid like runout motion (Davies & McSaveney, 2012) which shape landscapes worldwide. The Devils Castle rock avalanche consists of debris from the headwall which is made of the Gardison/Deseret Limestone (Baker, Calkins, Crittenden, & Bromfield, 1966), with boulders ranging up to 8 meters high. The deposit is found largely in wooded areas and has a distinct, hummocky surface morphology. The slide has a runout of approximately 1.5 km and is of particular interest due to its unusual narrowness and distinct curve at the toe of the deposit (Figure 2).

From field reconnaissance, we noted that the current topography expresses a gully that may have existed, which helped direct the runout, confining it and possibly

inducing superelevation at two bends, indicating high velocity. Through mapping of the deposit and a rigorous reconstruction of the likely topography before the slide, we determined an approximate volume estimate for the deposit of 1.7 million m^3. Through runout modeling, we found there are two possibilities for a location of the source. Both lie on the same headwall; one occupies a hollow and rock face found toward the east, while the other consists of the entire western face past a prominent rock fin. Part of the deposit toward the headwall has been concealed by a small glacial advance and extensive pariglacial modifications.

For the Devils Castle, we will be looking closely at triggering factors, including possible paleo-seismic events. Earthquake triggering is of interest due to other landslides found in the Wasatch Front that may have also been caused by seismic events. Recognition of these events is important, as characterization of these slides will provide data for other studies of earthquake-induced landslides and earthquake hazard scenarios (Ashland & McDonald, 2008). The goal of researching these prehistoric events, such as the Devils Castle rock avalanche, is to characterize the hazard through analysis of geologic data. As we better understand the processes and controls of these large-scale mass movements, we can use individual analyses to evaluate the risk posed by these extreme events.

REFERENCES

Ashland, F. X., & McDonald, G. N. (2008). *Reconnaissance of the Grandview Peak rock slide, Salt Lake County, Utah: a possible earthquake-induced landslide?* Salt Lake City: Utah Department of Natural Resources.

Baker, A. A., Calkins, F. C., Crittenden, M. D., & Bromfield, C. S. (1966). Geologic Map of the Brighton Quadrangle [map].

Davies, T., & McSaveney, M. (2012). Mobility of long-runout rock avalanches. In J. J. Clague, & D. Stead, *Landslides: Types, Mechanisms and Modeling* (pp. 50 - 58). Cambridge: Cambridge University Press.

Laabs, B. J.; Marchetti, D. W.; Munroe, J. S.; Refsnider, K. A.; Gosse, J. C.; Lips, E. W.; Becker, R. A.; Mickelson, D. M.; Singer, B. S. (2011). Chronology of latest Pleistocene maountan glaciation in the wester Wasatch Mountains, Utah, U.S.A. *Quaternary Research*, 272 - 284.

Madsen, D. B., & Currey, D. R. (1979). Late quaternary glacial and vegetation changes, Little Cottonwood Canyon area, Wasatch Mountains, Utah. *Quaternary Research*, 254-270.